

for the future by evaluating advanced technologies to determine the most appropriate and cost-effective applications of digital communication media and equipment, traffic applications software, and closed

circuit television camera equipment.

**Additional Programs**

ITSSU is driven to deliver on its promises for the North Carolina Department of Transportation (NCDOT), for the State of North Carolina, and for the people that we serve. While the functions of the unit are multi-dimensional and cross-sectional, many of the programs on ITSSU’s agenda require the combined efforts of all its sections and/or coordination with other sections of the NCDOT outside the ITSSU. Such programs include, but are not limited to, our involvement in the Transportation Improvement Program, Spot Safety and High Hazard Elimination Programs, Railroad Inspection Program, and Traffic Signal Timing Program. The ITSSU meets frequently with traffic signal contractors and NCDOT signal technicians to discuss issues related to design, construction, and maintenance of traffic signals and ITS technologies.

The Transportation Improvement Program is a long-range, innovative schedule of construction projects that embraces all modes of Transportation. During such construction, use of temporary traffic signal configurations to accommodate proposed roadway widening, proposed lane configuration changes, or the use of temporary haul roads for construction equipment may be necessary. Extensive coordination must be maintained with the Work Zone Traffic Control Unit. Assistance is also provided to the Resident Engineer and



The Spot Safety Program and the High Hazard Elimination Program were established as a means to respond quickly to safety related transportation improvement needs. These programs are geared toward expediting safety related improvements and the alleviation of traffic congestion. Improvements may involve more than signal design modifications and can include one or more of the following: the addition of medians, turn lanes, intersection realignment, and/or the reduction of vertical and horizontal curvature. Due to the sensitivity of motorist, safety projects initiated under these programs have short, critical deadlines.

Under the Traffic Signal Timing Program, the ITSSU prepares fully engineered signal system plans, installs these plans, and makes field adjustments during on-site observations of traffic flow. Plans, specifications, and estimates prepared may also involve signal systems for closed loop corridor projects and time-based traffic signal systems. Traffic modeling software is heavily utilized in preparing and evaluating signal timing and traffic pattern proposals. New developments and growth in residential areas may increase traffic demands at signalized intersections, while opening new roadway routes may decrease traffic demands at other locations. Though modern traffic signal equipment may have the ability to make “on the spot” adjustments, limitations of the equipment still make field observation and adjustment of the timing parameters and traffic patterns crucial to maintaining safe and efficient operation.



The field of traffic engineering is a highly technical, innovative, and constantly changing discipline. The ITSSU is dedicated to the highest level of serviceability attainable. By enhancing motor vehicle safety, improving highway operations, increasing effective capacities, and sponsoring continued training and research, the Unit strives to fulfill North Carolina’s growing transportation needs.

For more information, please contact us at:

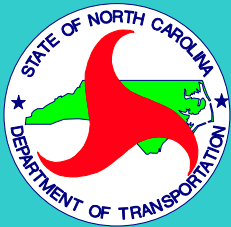
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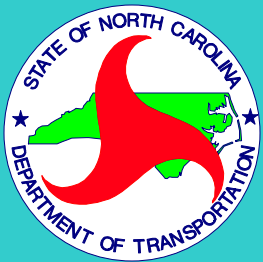
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*Eighth Revision:*  
*Cheryl Collins*  
*January 2008*



# Intelligent Transportation Systems & Signals Unit

The mission of the Intelligent Transportation Systems & Signals Unit is to provide safe, efficient movement of traffic at signalized intersections and on congested corridors through the analysis, design, and implementation of traffic signal and intelligent transportation system plans; development of associated project specifications; development of equipment specifications; and development of signal timing.

*G. A. Fuller, P.E.*  
*State ITS & Signals Engineer*

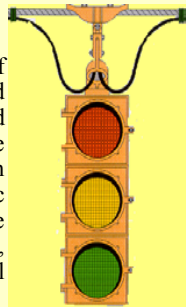
## Intelligent Transportation Systems & Signals Unit

The Intelligent Transportation Systems and Signals Unit's (ITSSU) core mission is to improve the safety and operating efficiency with technology applied to the existing infrastructure. Directing traffic flow along our State's highway infrastructure requires the mobilization of the sophisticated technologies used in Intelligent Transportation Systems (ITS) and coordinated traffic signal systems. ITS incorporates current and evolving computer and communication equipment with all aspects of traffic control including signalized intersections to provide safer, more efficient, and better coordinated solutions to today's transportation problems. Traffic signals and their related hardware compose one of the most intricate systems in use by the general public on a daily basis. Collectively, ITS and coordinated traffic systems exert a profound influence on the lives of the State's populace. Therefore, implementing and maintaining the proper application, design, and installation of these systems is paramount to ITSSU. The Unit strives to improve the effectiveness of the existing transportation network through the dedication and collaborative efforts of the civil, electrical, and structural engineers within its three sections: Intelligent Transportation Systems, Signals and Geometrics, and Signals Management. Together these sections are responsible for planning, designing, procuring, implementing, maintaining and integrating ITS and traffic signal systems throughout the State

Highway System.

### Signals and Geometrics

The most fundamental application of traffic control is the signalized intersection. The Signals and Geometrics Section provides the ITSSU and the State of North Carolina with safe, efficient traffic signal operations through the development of plans, specifications, and estimates for all traffic signal and system work to be performed



on the State Highway System. Traffic signal plans begin with a field investigation to examine traffic conditions and to generate a detailed survey of the intersection. The Signal and Geometrics Section develops *Part 4 of the North Carolina Supplement to the Manual on Uniform Traffic Control Devices*.

After preliminary field investigations and basemaps are completed, an intersection capacity analysis is generally performed to identify possible deficiencies involving such items as turn lane storage capacity, number of lanes for movements, and intersection delay. Signal phasing, vehicle detection layout, and timing requirements are then determined accordingly.

Traffic signal plans may also include distinctive features that are tailored to meet the specific needs of each location. For example, the use of special pre-emptive phasing provides safe entry into traffic flow for emergency vehicles. Structural signal supports such as metal poles and mast arms offer safety in inclement weather and permanent stability. Because timing is critical to the operation of a traffic signal, Signals and Geometrics also has a specialized staff devoted solely to the development of timing plans and the management of changing traffic volumes. Engineered adjustments in timing parameters help complete Signals and Geometrics' mission to provide safe, efficient, and economical traffic operation.

The Signals and Geometrics Section also reviews municipal and privately prepared traffic signal designs to ensure the safety of the public and to uphold the State's standards of efficient signal operation. In conjunction with the Signals Management Section, the section evaluates new technology and develops pilot programs for initiating its usage. For instance, Light Emitting Diode (LED) traffic signal displays reduce the risk of signal light failure, increase the visibility to motorists, and decrease the cost of maintenance to the State. Other improvements include fiber-optic and LED signage and improved vehicle detection schemes. Results of these initiatives are transferred both directly to traffic operations and indirectly to the environment through decreased pollution and energy consumption.



### Signals Management Section

With the completion of the signal design, the focus turns toward the equipment. The Signals Management Section is involved in all stages of planning, construction, and operation of traffic signal networks.

The section prepares electrical designs for signal installation as well as materials and construction specifications, and material estimates. The section is also responsible for the application and procurement of traffic signal equipment. Included in this work is the preparation of a multi-year purchasing bid for traffic signal equipment. The section manages the inventory of equipment by making recommendations regarding future purchases, inspecting incoming equipment and resolving quality control issues.

The section maintains the NCDOT Qualified Products List (QPL) for traffic signal equipment and pre-approves most equipment used on the State Highway System.



Vendor's products must first be evaluated for conformance with specifications to be considered eligible for the QPL. Traffic signal equipment and other

electronic equipment associated with copper and fiber optic-based communications systems, video surveillance systems, dynamic message signs and other ITS equipment are repaired down to the component level at the Traffic Electronics Center. ITSSU's design engineers rely heavily on Signals Management for their expertise in electronics and their ability to interface the functionality of design with the practical application of advanced technology. This dependability carries over to on-site applications as Signals Management reviews field equipment and ensures that new equipment provides adequate traffic and diagnostic information to its operators. They respond to emergencies and provide technical assistance to field personnel in the diagnosis of malfunctioning signal equipment. From the procurement of equipment and the maintenance of traffic signal equipment inventories to reviewing construction practices and performing on-site and centralized training programs, Signals Management keeps North Carolina's traffic signal network operational.



### Intelligent Transportation Systems Section

The Intelligent Transportation Systems Section is ITSSU's delegate charged with improving transportation operations and increasing effective capacities through the production of ITS plans and the interconnection of multiple traffic signals. With ITS technology, the vehicle, driver, and highways are united as an integrated traffic control system to increase the overall safety and efficiency and reduce congestion.



ITS uses surveillance cameras, vehicle detection, and computerized communication, to monitor traffic flow along a corridor. A computer, or master controller, is used to link each of the designated signalized intersections together and to match the detected changes in traffic demand with the appropriate timing schemes. Synchronization between each location is made possible via communications cable. The Intelligent Transportation Systems Section routes the communications cables and eliminates possible utility conflicts. Their contributions allow ITSSU to economically enhance motor vehicle safety, maximize existing roadway capacity, and provide the State of North Carolina with an effective transportation system. The Intelligent Transportation Systems Section also handles the planning, designing, and implementing of computer based systems within municipalities for ITSSU.



In addition, the Section executes ITS initiatives such as freeway management systems, traffic surveillance systems, roadway weather information systems, reversible lane control systems, and transportation management centers on the State Highway System. It is continuously preparing